

Typhoon Joe, the ninth tropical cyclone in the Western Pacific region, proved to be very predictable. A near static synoptic pattern prevailed in the mid- to upper-troposphere within the subtropics throughout most of Joe's existence. Figures 3-09-1 and 3-09-2 show the distinguishable traits in the structure of the mid- and upper-troposphere. As a result of this pattern, Joe followed a nearly straight track from genesis to dissipation with few exceptions.

Joe's genesis from a tropical disturbance into a mature tropical cyclone was slow. Satellite imagery first indicated a disturbance along the equatorial trough on 14 July over the Caroline Islands. Later satellite data revealed a gradual increase of convective activity with an apparent increase in organization. As a result of the information received from this series of satellite imagery, a tropical cyclone formation alert (TCFA) was issued at 2153Z on the 15th.

The first aircraft reconnaissance of the disturbance on the 16th found a weak surface circulation which did not extend up to the 700 mb level. At that time the minimum sea

level pressure was 1006 mb and the disturbance was tracking northwestward at 14 kt (26 km/hr). Defense Meteorological Satellite Program (DMSP) imagery at 0021Z on the 17th suggested that the disturbance was developing a circulation center that extended at least to mid-tropospheric levels (Fig. 3-09-3) with strong convective activity located west of the exposed surface circulation. As discussed by Huntley and Diercks (1980), weak developing tropical cyclones often have the 700 mb center displaced from the surface circulation in the direction of strongest convective activity. As the tropical cyclone develops and intensifies, the surface circulation moves under the 700 mb center and becomes vertically aligned. Later satellite data did show that the surface center had moved closer to the area of strong convection. This sequence of events prompted JTWC to issue the first warning at 0000Z on 17 July for Tropical Depression 09. Aircraft reconnaissance on the 17th substantiated that the disturbance had indeed developed significantly since the 16th and that TD 09's circulation center had extended up to the 700 mb level with no significant displacement of the surface and 700 mb center noted at that time.

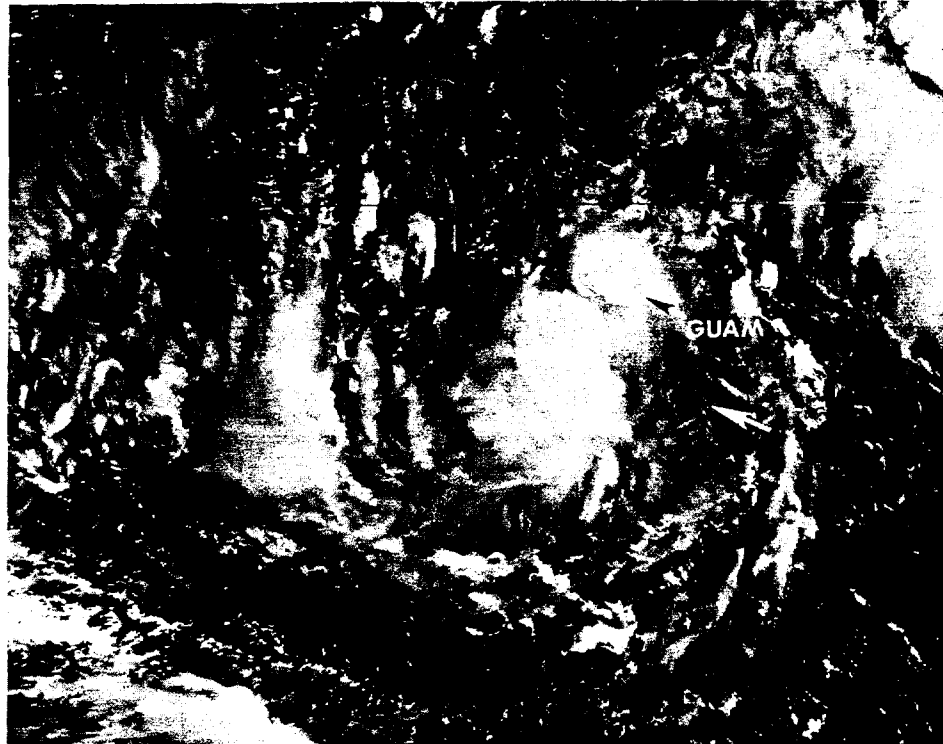


FIGURE 3-09-3. Typhoon Joe during his early stage of development, 17 July 1980, 0021Z. Arrow shows location of exposed low-level circulation center. (DMSP imagery)

FIGURES 3-09-1 and 3-09-2 are on the following page.

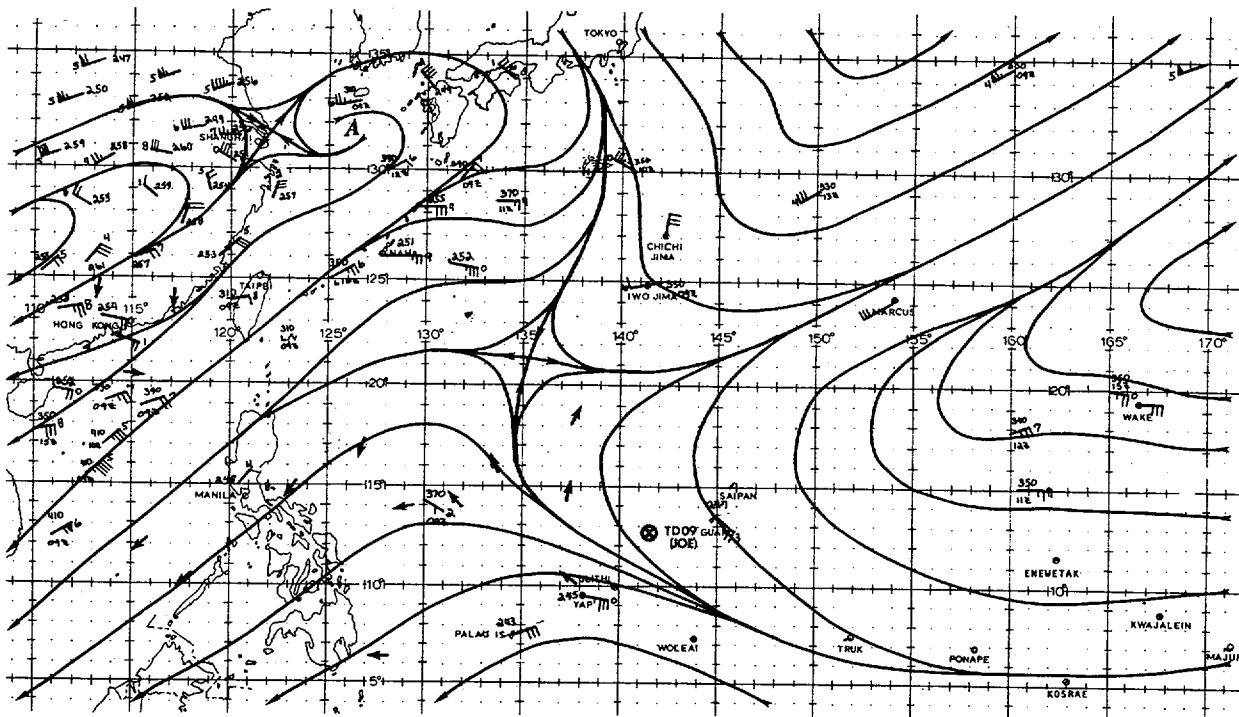


FIGURE 3-09-1. 200 mb streamline analysis at 171200Z July 1980. The analysis depicts the synoptic pattern which prevailed during much of Typhoon Joe's existence. Wind data are a combination of RAOBS, AIREPS, and satellite-derived (+) winds for the 250 mb to 150 mb levels. Wind speeds are in knots.

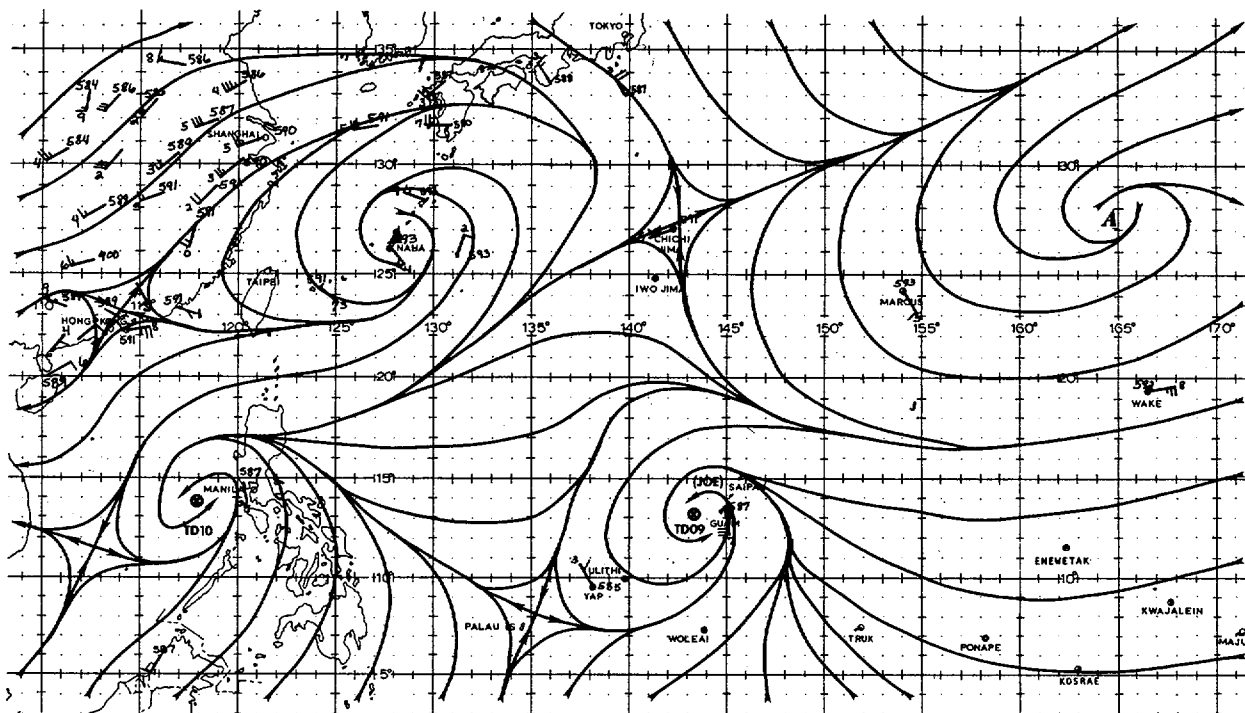


Figure 3-09-2. 500 mb streamline analysis at 170000Z July 1980. The analysis depicts the synoptic pattern which prevailed during much of Typhoon Joe's existence. Wind speeds are in knots.

TD 09 developed rapidly from that point and was upgraded to Tropical Storm Joe on the 18th. Typhoon strength was attained on the 19th.

As mentioned earlier, Joe tracked along a nearly straight course through much of his existence. His forward speed of movement was rapid and nearly constant, even while passing over Luzon. This unusually persistent track and high speed of movement was correlated with an abnormally strong mid- and upper-tropospheric subtropical ridge. The subtropical ridge at both levels deviated significantly from the climatological norm. The 200 mb anticyclone, normally located over the China mainland, extended further east to the north of Joe's track and south of Japan (Fig. 3-09-1). Similarly, the mid-tropospheric ridge was to the north of Joe's track and was much stronger than normal (Fig. 3-09-2).

This pattern did not significantly change during Joe's lifetime, except briefly while he was first developing into a tropical depression. Joe's track took a slight northwestward jog in response to a short wave trough which weakened the mid- to upper-tropospheric ridge. This short wave trough quickly passed eastward and the ridge built back north of Joe.

Six hours prior to landfall over Luzon, Joe attained an intensity of 105 kts (54 m/sec) with a minimum sea level pressure of 940 mb at 1200Z on 20 July. Joe weakened rapidly to tropical storm strength while crossing Luzon, but still remained very destructive. As he tracked across the mountainous terrain of Luzon, where peaks approach 10,000 ft, the track deviated slightly, becoming more westward. It took just over 6 hours for Joe to cross Luzon, but in that short time, the Philippine Islands were inundated by heavy rains which produced massive flooding and resulted in extensive crop and property damage.

Approximately 177,000 people were left homeless and 19 deaths were reported. Exact figures could not be compiled in time due to Typhoon Kim which hit the Philippines within a week of Joe, compounding destruction that the Philippines had already suffered. No significant damage was reported to U. S. military installations in the Philippines.

Upon entry into the South China Sea, Joe reintensified to typhoon strength. Before this time, JTWC expected Joe to track northwest onto the Asian mainland about 100 nm (185 km) west of Hong Kong and dissipate. The mid- and upper-tropospheric ridge, however, extended westward, causing Joe to continue on a west-northwest track toward Vietnam. Also, from the time Joe entered the South China Sea through dissipation, he maintained a rapid speed of movement due to the strong ridge to the north. Typhoon Joe attained a second maximum intensity of 90 kt (46 m/sec) as determined by Dvorak analysis of satellite data (Fig. 3-09-4). At the time of maximum intensity, the radius of winds greater than 30 kt (15 m/sec) extended 450 nm to the east of Joe's center, covering most of the South China Sea north of 10N. While transiting across the South China Sea, Joe devastated the coastal regions which paralleled his track. Much damage to crops and property occurred in southern China due to flooding caused by torrential rains. Joe also left many homeless and claimed more lives while tracking toward Vietnam.

Satellite imagery showed that Joe had an eye as he made landfall near Haiphong, Vietnam. During this period, winds were reported in excess of 70 kt (36 m/sec) by the Vietnam News Agency. After landfall, Joe dissipated rapidly due to land and vertical wind shear effects. The final warning was issued by JTWC at 0000Z on 23 July as the remnants of Joe began to dissipate over the mountains of Laos.

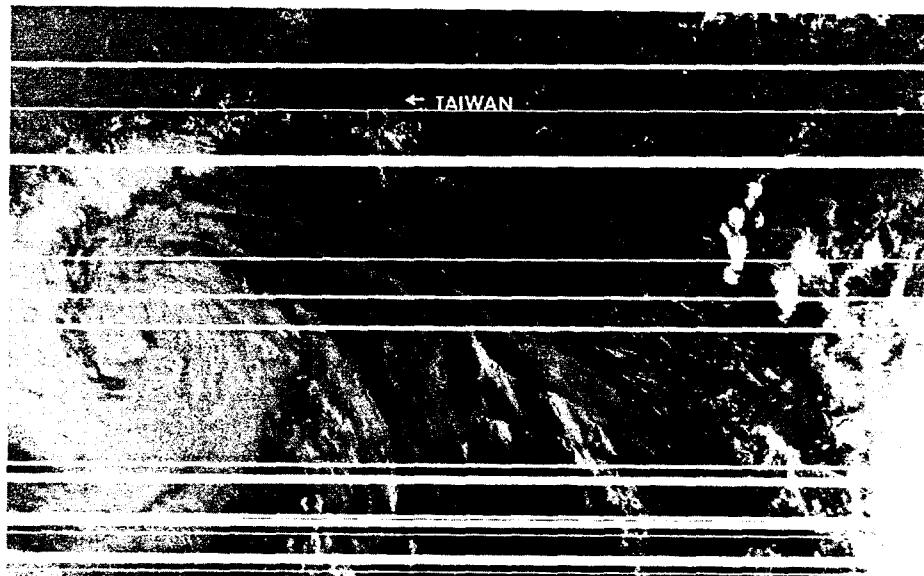


FIGURE 3-09-4. Typhoon Joe after reintensifying to 90 kt (46 m/sec) in the South China Sea, 21 July 1980, 2347Z. {DMSP imagery}